

2004 SAGENAP REPORT

2.3.6 SuperNova Acceleration Probe (SNAP) R&D

The SuperNova Acceleration Probe (SNAP) is a proposed implementation for the JDEM mission to study dark energy. SNAP has been in serious development for several years, with several significant developments taking place in the last two years. First, NASA and DOE announced they would support a Joint Dark Energy Mission (JDEM), and the SNAP team responded by focusing their efforts on preparing for the upcoming competition. In addition, the SNAP collaboration has expanded to more than 100 members from a dozen institutions. SAGENAP received a report from SNAP on the status of its R&D effort.

The scientific goal of SNAP is to characterize the dark energy by measuring its equation of state, w , and its change with time, w' , by detecting and following 2,500 type Ia supernovae out to redshift values of $z = 1.7$. In addition, SNAP plans an ambitious weak-lensing survey that will measure the same dark energy parameters in a complementary way. The supernovae will be studied by repeatedly imaging a 15 deg^2 field in nine filter bands, discovering and obtaining light curves by difference imaging, and by obtaining spectra to get the type, redshift, and detailed information for each supernova. For the weak-lensing project the 120 images of each field will be co-added to reach a limiting AB magnitude of 31. In addition, a 1000 deg^2 survey down to a limiting AB magnitude of 27.7 will be done. By detecting more than 100 resolved galaxies per square-arcminute with a small and extremely stable point-spread function, SNAP should also produce a superb weak-lensing data set.

SNAP is a relatively mature and well-developed concept, in comparison with other major missions being proposed to study dark energy. Recent work by the SNAP team includes the development of a sophisticated simulation tool that has firmly established the need for a space mission in order to fully understand supernovae at redshifts greater than one. The simulation also permits quantitative comparisons to be made between various experimental designs. Important areas of focus are on the calibration system and on the control of systematic errors, the latter which the SNAP proponents believe are key to getting believable dark energy results.

The team has completed designs for many aspects of the project including the telescope, focal-plane layout, CCD sensors, custom electronics, and orbit. Substantial progress has also been made on the remaining aspects of the mission, including the spectrograph, infrared sensors, spacecraft, and system integration. An important issue that is being attacked is related to the availability and suitability of the infrared (IR) detectors – it is good news that there might be more than one vendor for these. SAGENAP was impressed at the continual and substantial progress made by SNAP towards a fully-designed mission. The team estimates that in two or three years they will have a detailed mission design, schedule, and cost that will provide the basis for serious evaluation by DOE and NASA.

SNAP remains an extremely well-motivated experiment for determining the nature of the dark energy that is causing the accelerated expansion of the universe. We endorse the team's approach of understanding and minimizing systematic errors. The team is very strong and has grown to include more traditional space and astrophysics personnel. While other techniques for studying the equation of state of dark energy are being developed, so far none are as mature as SNAP or have shown better capability. The science case for performing such a measurement continues to get stronger, as does the team and its mission design.